Air Toxics Exposure in Indoor Environments

EPA Workshop on Air Toxics Exposure Assessment

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Why is the Indoor Environment Important?

- High exposures indoors
  - Many pollutants 2-5 times higher than outdoors
  - Typically up to 90% of time spent indoors
- Typically outdoor air establishes the baseline indoor air concentrations
- Indoor sources add to these baseline indoor air concentrations
  - Building materials, products, occupant activities

Indoor Air Toxics Agenda

- Sources of indoor air toxics
- Relative Ranking of Indoor Air Toxics
  - Recent examination of indoor air toxics exposure data
- Detailed data from one exposure study
  - Range of indoor air toxics
  - Comparison of indoor and outdoor air toxics concentrations
  - Exposure data gaps

Indoor Air Toxics Agenda

- Will not discuss ETS or Rn
- They are air toxics
  - Rn is even listed as a HAPS
- Risks are high
  - Even at Rn action level,still have a risk of 10^{-3} (for never smokers)
- But having good exposure data is less of an issue for them

Indoor Air Toxics Relative Ranking
Assessment and Setting Priorities

- Currently conducting a relative ranking of indoor air toxics to assist in setting priorities
  - An "order-of-magnitude," screening-level, risk-based analysis
- Used same methodology as used for selecting 33 HAPs from outdoor sources
  - General considerations on health effects for indoor air pollutants are the same as for outdoor air pollutants
  - For a given exposure route, the body doesn't care about the source of benzene; it only cares that it is in contact with benzene and for how long this contact lasts

Indoor Air Toxics Relative Ranking
Assessment and Setting Priorities

- Used monitoring studies conducted in last 10-15 years
- Focused on non-industrial buildings
  - Homes, schools, office buildings
- Focused on typical indoor environments
  - not studies of new buildings, paint stripping, etc.
- Examined metals, aldehydes, VOC, SVOC
- Addressed acute and chronic health effects

Indoor Air Toxics Relative Ranking
Assessment and Setting Priorities

- Ranking limited to individual chemicals, not mixtures (such as ETS)
- Does not include biological contaminants
- Inhalation exposures only
- Used as RELATIVE ranking to set priorities

Indoor Air Toxics Relative Ranking
Assessment and Setting Priorities

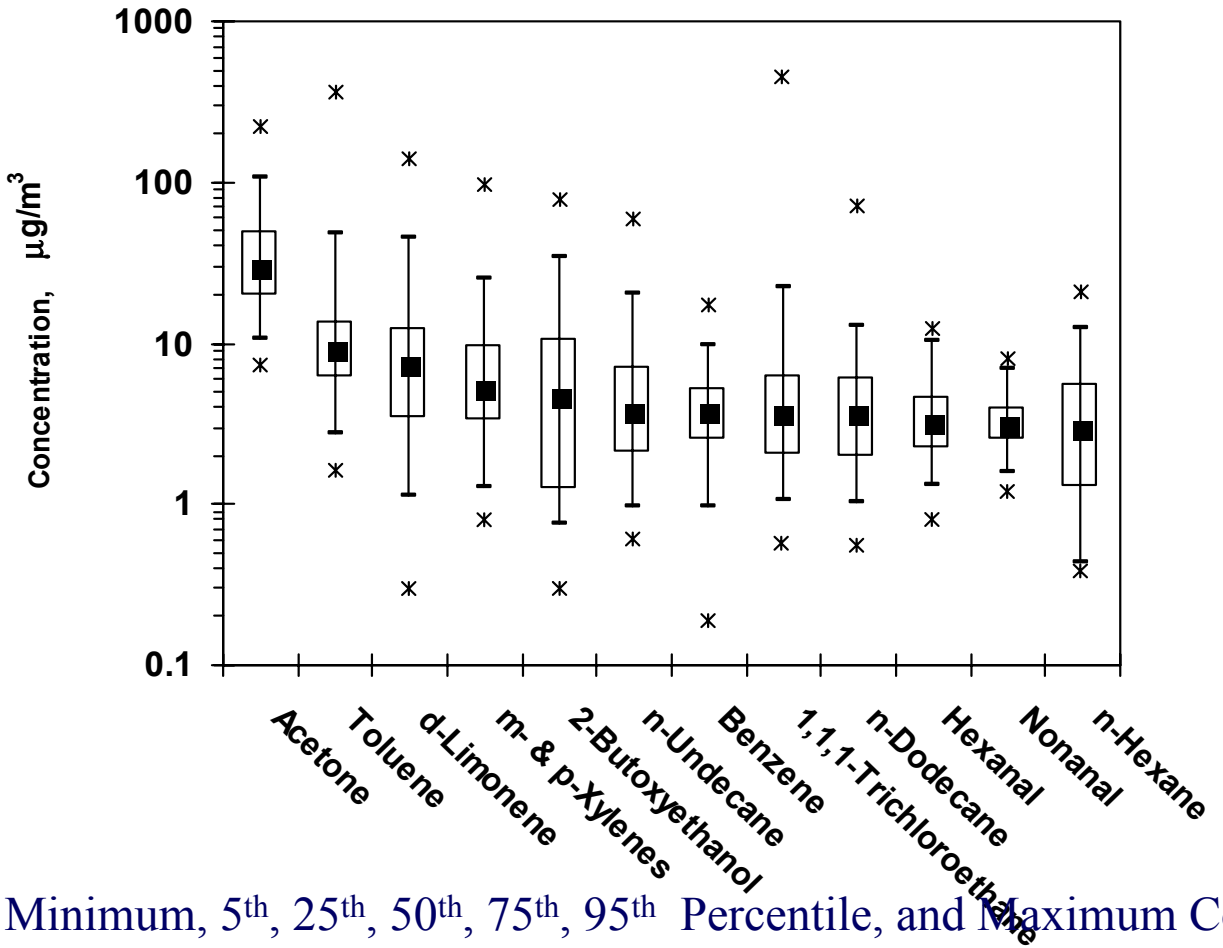
- 10 studies
- 213 concentration records for 112 air toxics
  - 213 had an estimate of the indoor central tendency
  - 192 had an estimate of the indoor upper limit
  - For 154, could calculate the difference between indoor and outdoor mean concentrations

Indoor Exposure Data

- **Office buildings** (good data: BASE, TIME, Cal. Healthy Buildings Study)
- **Residences** (some good data but need more current data: TEAM Study)
- **Schools** (need more data: only a few intervention studies)

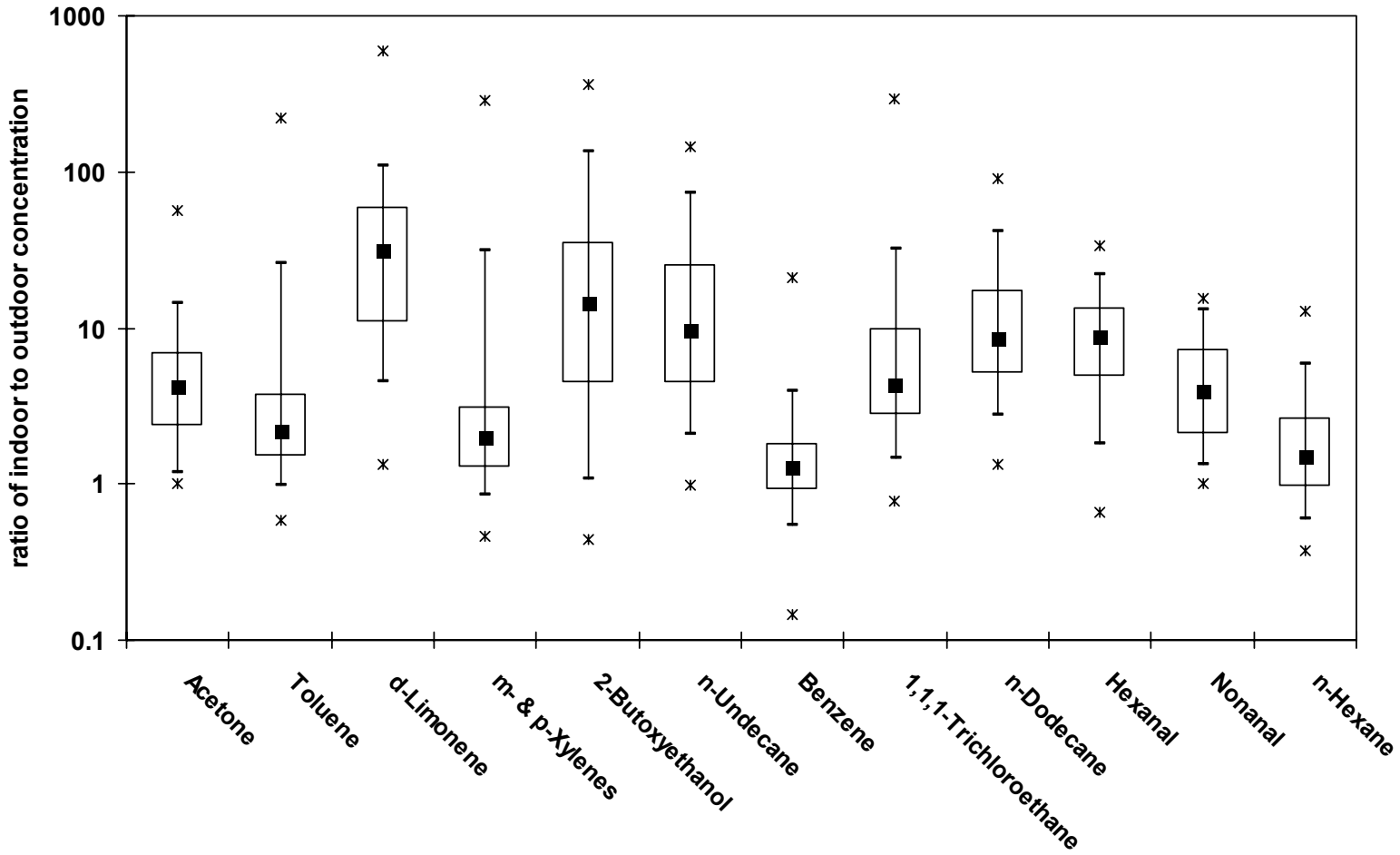
VOCs with Highest Median Values

(Office Buildings, multisorb, n=56)

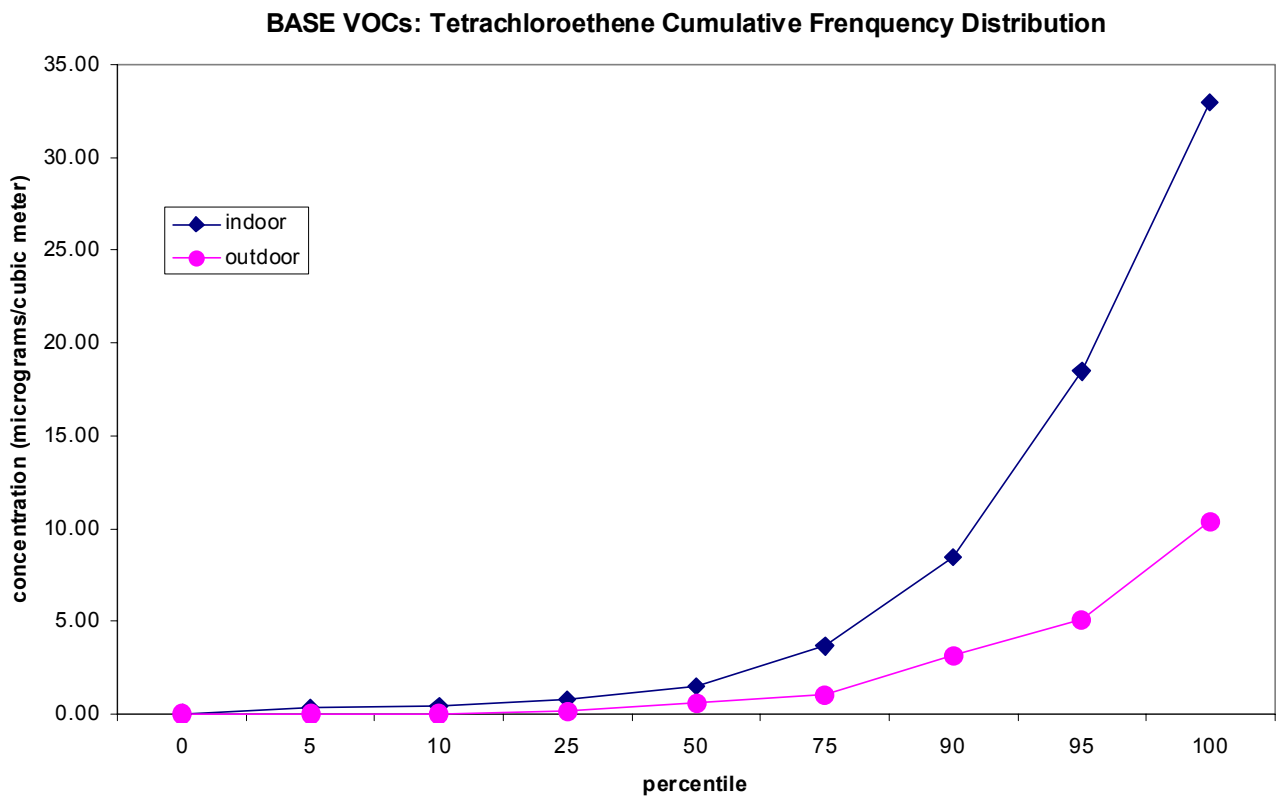


Minimum, 5th, 25th, 50th, 75th, 95th Percentile, and Maximum Concentrations for BASE VOCs Measured Indoors by Multisorbent Methods for 12 VOCs

Minimum, 5th, 25th, 50th, 75th, 95th percentile, and Maximum for Indoor to Outdoor Concentration Ratios of BASE VOCs Measured by Multisorbent Methods for 12 VOCs with Greatest Indoor Medians

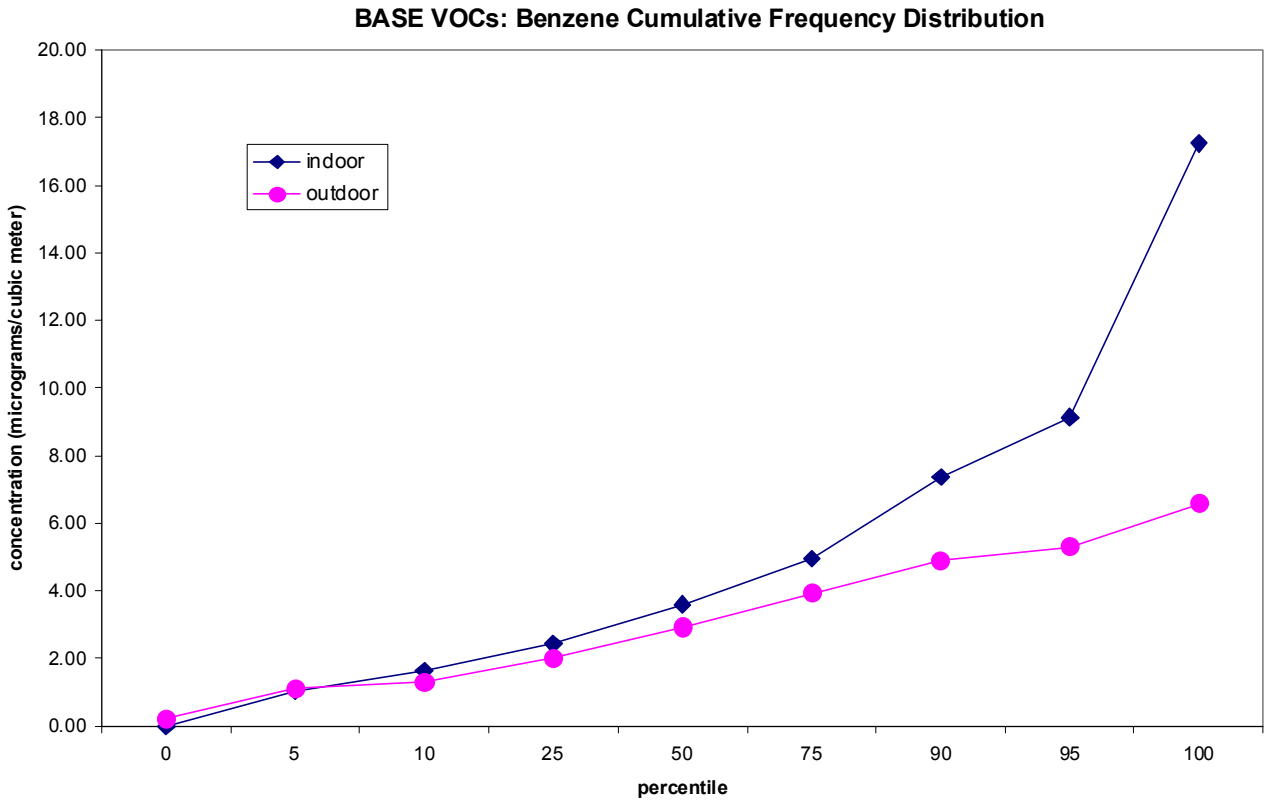


Tetrachloroethene
frequency distribution



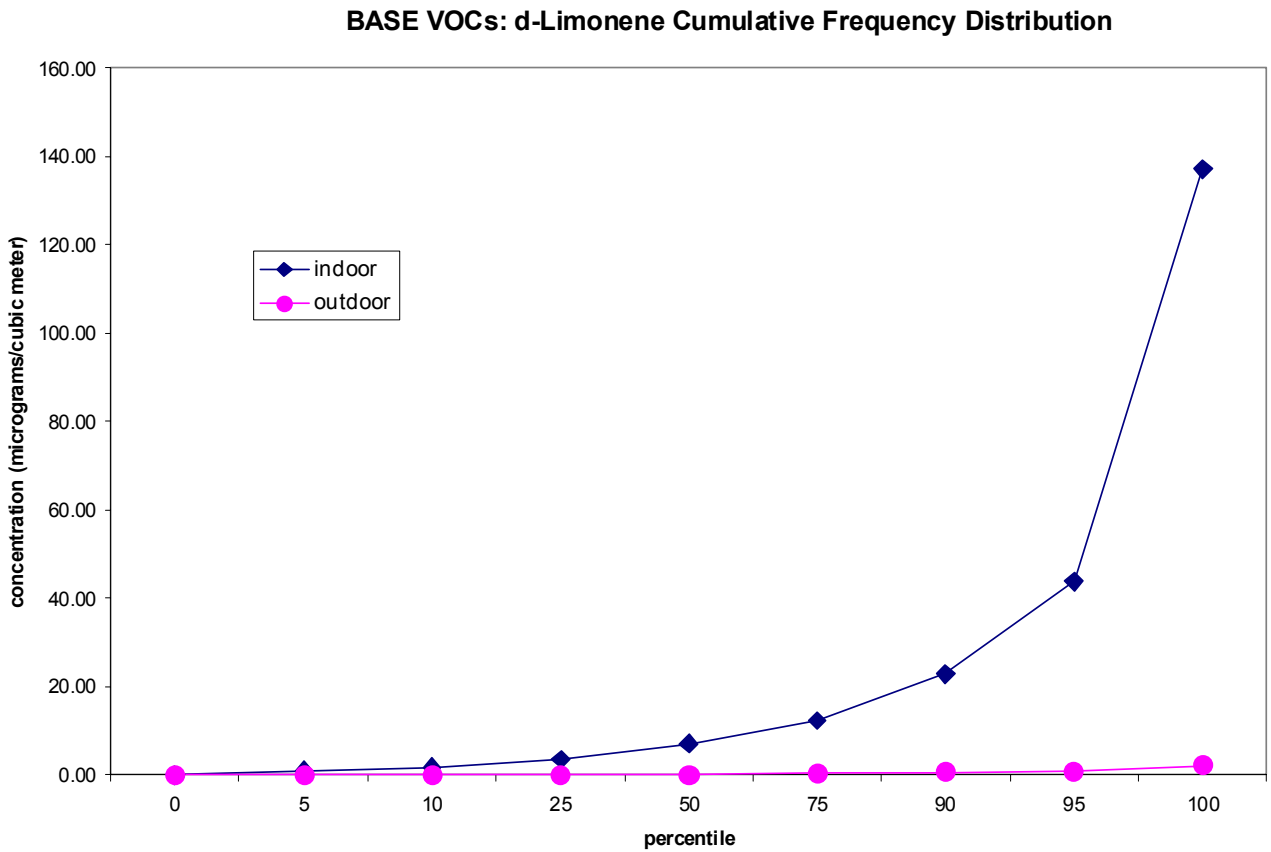
N= 70 BASE buildings
Building Frequency Detected = 100%
Sampling Method - multisorb

Benzene
frequency distribution



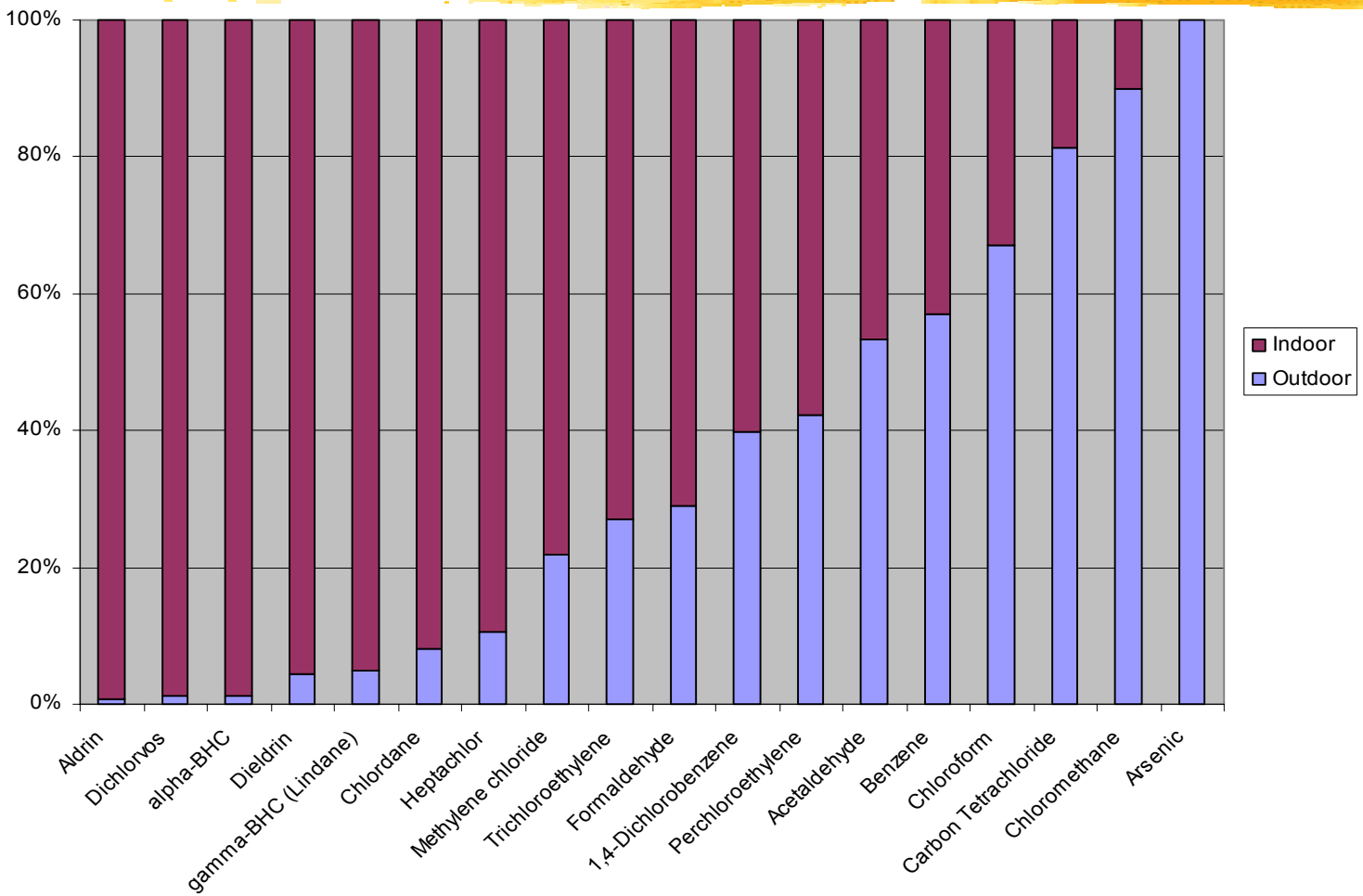
N= 70 BASE buildings
Building Frequency Detected = 100%
Sample Method - multisorb

d-Limonene
frequency distribution



N= 70 BASE buildings
Building Frequency Detected = 100%
Sampling Method - multisorb

Relative Concentrations for Selected Air Toxics



Ranking of Indoor Air Toxics

- Ranking not completed yet
- However, some air toxics likely to emerge as higher priority indoors
  - Aldehydes, benzene, halogenated hydrocarbons, pesticides

Indoor Air Toxics Exposure Data Gaps

- Insufficient data for several building types
  - Residences
  - Schools
  - Other?
- Insufficient data on high exposures ("hot spots")
  - Often focus on typical environments
  - Need information on frequency of high exposure
  - Individual vs. population risk
- Lack source emissions inventory
- Lack health effects data to direct exposure research

Why have an Integrated Approach for Air Toxics?

- Both I & O exposures to air toxics are important
- I & O are interdependent
  - Outdoor air toxics infiltrate or are ventilated indoors and set baseline level indoors to which indoor sources add
  - Indoor emissions are ventilated outdoors
- Many of the same air toxics are important I & O, but not all outdoor air toxics are important indoors and vice versa
- I & O risk reduction methods do not always overlap
- Incorporating IA with OA should not greatly impact ongoing air toxics activities and schedules
- For meaningful reduction of risks, must address BOTH indoor and outdoor sources of air toxics.